F. WILFRID LANCASTER
Professor
Graduate School of Library Science
University of Illinois
Urbana-Champaign, Illinois

Have Information Services Been Successful? A Critique

This paper is somewhat different from those presented earlier. The others have dealt with experiences in the provision of information services through the use of machine-readable data bases. By and large, they reported successes. The present paper is more a series of observations and impressions on the achievements of the field of information service in the past twenty years. In particular, it is my intention: (1) to point out certain failures, or at least limitations, of existing information services, (2) to mention some findings on use and users of information services that seem to be of special significance, and (3) to suggest some directions for future work. I intend here to raise questions rather than to answer them. In parts, at least, the paper is deliberately provocative and should be viewed in this light.

> An information retrieval system will tend *not* to be used whenever it is more painful and troublesome for a customer to have information than for him not to have it.

This statement was made in 1960 by Calvin Mooers[1] and is frequently referred to as "Mooers's Law." It is perhaps the single most important quotation in the entire literature on the provision of information service.

Convenience appears to be the single most important factor determining whether or not an information service will be used. It is the overriding

consideration in the information-seeking behavior of professional people. It has been shown by a number of investigators, most notably by Allen and Gerstberger[2] and by Rosenberg,[3] that professionals needing information are likely to turn first to the most convenient source, even if they recognize that another source is in some sense better (e.g., more complete or more current). In studies of information-seeking behavior in various subject fields, when professionals are asked to rank information sources in order of importance, libraries consistently appear rather low in the rankings. In fact, formal information sources in general may be ranked rather low. A number of these studies have revealed that personal files are extremely important sources of information and that these files are likely to be the first source that a professional will turn to when the need for information arises. Soper discovered that there is a strong tendency for a bibliographic item cited by an author to appear in his personal collection, and that this tendency applies to the humanities and social sciences as well as to the field of science.[4]

If the personal files do not provide the information needed, the professional is quite likely to turn to an informal channel of communication. He or she will contact a professional colleague, in the same institution or outisde it, frequently by telephone. It has long been recognized that in virtually all fields there exist well developed networks of informal communication, sometimes referred to as "invisible colleges." If a sociometric analysis is applied to a community of information users, it is likely to reveal a number of sociometric stars or information gatekeepers—individuals to whom others turn for information. An elaborate and effective communication network is built around these stars, and information flow within such a network has been referred to in epidemiological terms. Crawford, among others, has pointed out that information supplied to the sociometric stars is likely to spread through the community like an infection.[5] This seems to be a phenomenon highly significant for the design and implementation of information services.

I recently completed a study that highlights in several ways the importance that convenience plays in the acquisition of information.[6] The study relates to information-seeking behavior in the neurosciences. The recipients of two current awareness publications of a specialist nature (one relating to Parkinson's disease and one to brain chemistry) were asked to rank information sources in order of their importance. The single most important source, even in these highly specialized areas, was *Current Contents*, a general alerting mechanism. There seem to be a number of good reasons for the importance of this publication, including its convenient format and the fact that it is a very current information source (at least as far as the journal literature goes). There is another extremely important reason: the publication provides convenient sources for document delivery, both by its guaranteed tearsheet service and by the fact that it supplies addresses of authors to

facilitate the requesting of reprints. Of the several hundred neuroscientists who participated in this study, the great majority seem to favor a document source that they can use without leaving their desks (through a postcard requesting a reprint or a tearsheet) rather than a source that usually requires a personal visit (an academic or special library) and the use of procedures that may sometimes seem bureaucratic. It seems clear that in building their own document collections many scientists rely rather heavily on writing to other scientists for reprints of their articles, another manifestation of informal channels of communication. It is interesting to note that, in this study, the inclusion or exclusion of the addresses of authors was regarded as a highly significant factor in the evaluation of printed current awareness devices. Once more, ease of use and personal convenience are shown to be factors of paramount importance in the evaluation of an information source. I will return to this later.

The Achievements of Information Services

There is little doubt that giant strides have been made in the provision of information service in the past twenty years. The application of computers to information retrieval has allowed a depth of indexing, and a depth and complexity of search, that was virtually impossible in earlier systems. The application of computers to the printing and publishing industries has led to the generation of numerous machine-readable data bases that can, in turn, be used to provide other forms of information service, both current and retrospective. Computer-based selective dissemination of information (SDI) to individuals or to groups offers a more efficient, comprehensive current awareness service than any provided earlier. The computer has also been used to generate new printed tools, including citation indexes, which would be almost impossible to construct on a large scale by purely manual processes, and specialized bibliographies produced essentially as by-products of more comprehensive publications (e.g., the recurring bibliographies of the National Library of Medicine). The computer has also permitted us to obtain a reasonable level of access to the previously elusive report literature through publication and retrieval systems developed by the National Technical Information Service (NTIS), the Defense Documentation Center (DDC), the Educational Resources Information Center (ERIC), the International Nuclear Information System (INIS), and others.

Automation has considerably extended the possibilities for cooperation among libraries and information centers. Machine-readable files can be shipped around rather easily so that truly national and international services can be developed. The paper by Dagmar Schmidmaier, elsewhere in this volume, gives an example of how one country (in this case Australia) may build information services around data bases created in other countries.

The availability of MARC tapes from the Library of Congress has greatly increased the possibilities for shared cataloging, perhaps best exemplified by the operations of the Ohio College Library Center. We can now see the beginnings of several important union catalogs and lists of serial holdings in on-line form.

It is likely that we will see more cooperative schemes whereby a number of libraries will share a central computer facility accessed by means of on-line terminals located throughout the member institutions for a wide range of bibliographic activities including acquisitions, cataloging, serials control, circulation control and interlibrary lending. Through an on-line network the files of all libraries in such a group, including their catalogs, can be physically far removed from the libraries themselves, yet readily accessible.

Another emerging important form of cooperation is the regional information center, as exemplified by the Northeast Academic Science Information Center (NASIC), described elsewhere in this volume by Wax. The goal of such a center is to provide access to a wide range of machine-readable files from a whole group of libraries in a designated geographic region.

Without much doubt, the greatest single development of the last decade in the provision of information service has been the move to on-line retrieval capabilities. On-line systems for information retrieval have all of the capabilities of off-line systems without any of their major disadvantages. On-line systems provide relatively immediate results, are interactive and heuristic (avoiding the blind one-shot searches that are characteristic of off-line systems), and allow various forms of browsing. On-line systems have *greatly* extended our capacity for machine literature searching by greatly increasing the number of centers with computer searching capabilities, and greatly enlarging the universe of librarians competent and experienced in this aspect of reference service. In certain types of libraries—particularly medical, industrial, and governmental—on-line terminals are now being used quite routinely in the provision of reference service. In these libraries, use of the on-line terminal is integrated with use of the more traditional information sources in printed form. In the papers in this volume by Dowlin and by Summit and Drew, we learn of two forms of exploitation of machine-readable files by public libraries. The extension of computer-based reference services to public libraries is truly an exciting development.

As a result of all of these activities, a new type of librarian is emerging: the information services librarian is a professional who specializes in the provision of information service from machine-readable data bases. As described elsewhere,[7] the information services librarian needs knowledge and skills beyond those normally found in a more "conventional" librarian. The information services librarian needs to know what exists in the way of machine-readable files, where these files are located, and how to obtain service

from them. This librarian may also be required to evaluate both data bases and service centers, and therefore needs to know something of evaluation methodology. In order to exploit machine-readable files effectively, the information services librarian needs to know a considerable amount about indexing techniques and about vocabulary control procedures, as well as about searching strategy. Clearly, the emergence of the information services librarian has important implications for library education in general.

The Limitations or Failures of Information Services

In the above discussion I have tried to give an overview of some of the more important achievements in the provision of information service in the last few years. Progress has been considerable, but what of the limitations or failures of existing systems? What still needs to be done; in short, what of the future? I would like to give to you some of my own ideas and suggestions on these matters. It is this aspect of my paper that is likely to be more provocative or controversial.

To begin with, I must admit to being diametrically opposed to most of the other speakers at this clinic in one important respect. I firmly believe that if on-line systems are to achieve their true potential in the provision of information service, we must remove the information specialist intermediary and make systems available for use directly by scientists, lawyers, engineers, doctors and other professionals from their own offices, homes or laboratories. The main reason for this statement is my conviction that we must be designing systems to serve a new generation of professionals. This new generation will have grown up with on-line terminals. They will have used on-line terminals as integral tools in the educational process in universities, high schools and even elementary schools. They will have used them in computer-aided instruction, in numerical calculation, and in other applications (e.g., charging out a book from the library).

This new generation of scientists, as well as other professionals, will expect to be able to access bibliographic files through on-line terminal devices. They will use bibliographic systems if terminals are readily available and if the systems are easy to use. There seems little doubt that terminals will be widely available in laboratories, offices, and even in homes. But will our information systems be easy to use?

It seems that we have not given a great deal of consideration to the design of on-line retrieval systems oriented toward use by individuals who are not information specialists. Indeed, as I have pointed out elsewhere, many of the on-line services now in use are former off-line services that have been converted to an on-line mode of access with very few other changes.[8] These off-line systems were designed to be used by information specialists.

Generally, for truly effective use, these systems require fairly extensive training and experience in indexing, in search technique, and in the nuances of a large and sometimes idiosyncratic artificial language in the form of a classification scheme, thesaurus, or list of subject headings. Such systems are designed to be used in a specific search mode. They are not designed with the end user in mind and, by and large, are not suitable for exploitation by the casual (i.e., infrequent) user. In other words, these systems are not user oriented.

Requirements of a User-Oriented System

A user-oriented system must be natural-language oriented. The scientist or other professional will have neither the time nor the inclination to learn the policies, protocols and possible eccentricities associated with human indexing and the use of a large controlled vocabulary. The scientist must be able to interrogate an information system in his own language—the language of scientific discourse, the language of scientific literature, and the language used to communicate with his colleagues.

He probably should be able to interrogate the system by means other than formal searching strategies based on Boolean logic. It may be desirable to allow him to query the system by a natural-language statement, as possible in such systems as SMART, LEADER and BROWSER. These systems are not question-answering systems of the type discussed elsewhere in this volume by Waltz. Rather, they are document or citation retrieval systems that operate essentially by pattern matching—that is, they seek out the documents whose word patterns best match the word pattern of the request for information.

We should also be looking more closely at different approaches to the searching of on-line systems, including searching on the basis of citation indexing and bibliographic coupling. In many retrieval situations, particularly in the sciences, the user does not come to the system knowing nothing about the literature. Indeed, it is quite likely that he is already familiar with some citations to relevant documents. In this situation he should be able to input the relevant citations and simply ask the system to find others like them (e.g., containing similar word patterns or indexed under similar terms).

Keeping convenience to the user in mind at all times, on-line systems should be designed to minimize keyboarding as much as possible. The user should be able to choose from options displayed to him by the system, perhaps (in the case of a video display) by touching the item with a light pen or even a finger. The major system commands should be represented by dedicated keys. Where keyboarding is needed, the system should be reasonably forgiving; it should not be unduly sensitive to minor errors of spelling, punctuation or spacing.

Computers have usually been applied to information retrieval appli-

cations in fairly pedestrian ways. They are used mainly as giant matching devices. The innovative applications have come in other fields, such as engineering design and computer-aided instruction. Everyone at this clinic has had the opportunity to see the PLATO system of computer-aided instruction. PLATO has a number of rather unique features including a plasma display, a touch panel, and microfiche and audio interfaces. I believe that the PLATO hardware lends itself to innovative approaches to information retrieval. In one application of PLATO, children can move objects around and put them into containers in order to learn numerical skills. By direct analogy, it should be possible to select terms from displays and place them into "containers" representing various logical search requirements.

Document Delivery

Over the past decade we have provided fairly sophisticated citation retrieval systems, but we have generally neglected the provision of adequate back-up for document delivery. We have created an anomalous situation in which a user might identify citations relevant to some information need in a matter of minutes through an on-line terminal, but might still have to wait several days or even weeks to obtain the documents cited. Clearly, in a really efficient service environment he should be able to obtain the documents in approximately the same time frame in which he finds the citations. A small number of on-line systems, including the New York Times Information Bank, provide rapid document delivery by means of a microfiche interface. It is already technically feasible to transmit microimages to viewing stations over very long distances, but this is still an expensive process.

The whole area of document delivery is one that has been sadly neglected in the design of information services. Most of the major producers of information services are satisfied with producing announcement devices. They either provide no back-up document delivery capability or only a very inadequate one. For the user, the ordering of a document should be as easy as circling a number on an order card. Some industrial information services and a few professional journals (e.g., *Automotive Enginnering*) do make it that easy. *Current Contents* also provides a convenient and rapid document delivery capability. Services of this type, however, should be the rule rather than the exception. A scientist who receives some current awareness mechanism directed to his office should also be able to order documents without leaving his desk. If we are prepared to design personalized current awareness services in which machine listings go directly to a user's office, why do we leave him to his own devices for document delivery purposes, usually requiring him to make a personal visit to the nearest library? In a well designed current awareness service, whether based on a published announcement device or a

machine listing, each citation should carry a unique identifying number. The user should be able to order documents from some designated central source simply by circling their numbers on an order card.

Fortunately, the situation in relation to document delivery may be changing. A number of university libraries, including those at Ohio State University and the University of Colorado, have introduced services whereby, in response to a telephone request, library materials are charged out and delivered to faculty offices. An interesting study of the impact of this type of service has recently appeared in a book by Dougherty and Blomquist.[9]

In future on-line information services, at least in certain applications, it will be important to provide document access in approximately the same time frame in which citation access is provided, using stored digital text or a microimage interface. At the very least, it should always be possible to place an order for a document at the on-line terminal. This feature has recently been introduced in connection with on-line access to the NTIS and ISI (Institute for Scientific Information) data bases.

Perhaps the most heartening development on the document delivery scene is the recognition, long overdue, by the major secondary services that the problem is a serious one and that the secondary services have a major responsibility in this area. The recent position statement on document access issued by the National Federation of Abstracting and Indexing Services (NFAIS) identifies the problem very neatly: "The findings of document access studies and the frequent user complaints received by Federation members focus attention on the seriousness of the document access problem. Indeed, member services not directly affiliated with a resource library may be doing themselves, as well as their users, a real disservice by not considering document provision a responsiblity on par with the provision of adequate and accurate abstracts and indexes."[10] The NFAIS statement also proposes a solution to the problem in the shape of a "coordinated document depository system" managed by NFAIS with government support. This is the right idea. Whether or not anything useful comes of it remains to be seen.

Users and User Needs

Many so-called user studies have been conducted by information professionals in the past twenty years. Regrettably, most of these have been a complete waste of time; they have told us nothing we really need to know in order to design new and improved information services. It is my contention that most of the handful of really useful studies have been conducted by sociologists. These are sociometric studies of how information diffuses within a particular community. We as information specialists need to conduct more studies of this kind in order to identify patterns of information flow and to

identify the sociometric stars or gatekeepers in various communities. Perhaps the needs of these people should be uppermost in our minds in the design of information services—the people in fact to whom our services should largely be directed, since information directed to them is likely to spread quickly throughout a widespread population.

However excellent large centralized information systems may be, they are unlikely to replace personal information and document files completely. Personal collections are likely to continue; they will still be the first source that the professional tums to when the need for information arises. Personal files have a number of important advantages over central files: they are immediately accessible physically, they contain evaluated items and, perhaps most importantly, they are-indexed in a unique way that represents the user's highly personal viewpoint on the subject matter. We in the information field have tended to overlook the importance of personal files as sources of information. We have done little to encourage the creation of such collections or to help users to organize them. In fact, they have sometimes been discouraged. Assistance in the building and maintenance of personal files would seem, however, to be a legitimate function of the information specialist. Recently, there has been some evidence of interest in this area, as exemplified by a few systems that have been designed specifically to provide on-line support to the personal files of researchers. Such systems include the Remote Information Query System (RIQS) at Northwestern University and the AUTONOTE system at the University of Michigan. I see the need within universities, research institutes, industry, and government agencies for on-line systems that will combine personal files with more general files in a kind of symbiotic relationship. From the same on-line terminal the scientist, or other specialist, would have access to a wide spectrum of information resources: personal files, departmental files, general institutional files (including the library catalog) and finally, various outside data bases of potential value.

Current Awareness Services

A great deal of effort has been spent in the development of so-called current awareness services in the last ten years, as best exemplified, perhaps, by SDI services. In truth, most of these services are not very current at all. Most concentrate on the journal literature, but much of this gets into the great secondary data bases (e.g., *Chemical Abstracts, Biological Abstracts, Index Medicus*) many months after publication. This particular delay, however, is only a minor part of the problem. When an article is published in a scientific journal it is more archival than truly current, since it is likely to appear a year or more after the research reported is completed and perhaps several years after the research project was begun. The scientific journal itself

tends to be a very inefficient mechanism for the dissemination of information. It has been pointed out, perhaps first by Herschman,[11] that the scientific journal attempts to undertake three separate and somewhat conflicting functions: an archival function, a social function, and a dissemination function. Many feel that the journal fulfills the first two functions rather well, but the third one rather badly. The scientific journal exists more to serve authors than to serve readers.

Research reported in the journal literature—if it is at the forefront of its field—will have been reported months, perhaps years, earlier at scientific meetings or in the technical report literature. The results of this research will already have been diffused throughout the invisible colleges. Not all will know about the research, but those scientists who are most integrated into the scientific community (who are usually the "key" scientists) will.

Why, then, do we base our current awareness services almost exclusively on the published journal literature, which is not current, and on machine-readable files based on this literature, which are less current still? The only truly *current* current awareness service is one based on ongoing research, disseminating information on research projects before their results are published; the most important example is the Smithsonian Science Information Exchange.

Current awareness services should emphasize ongoing research—and in a sense foster the invisible college phenomenon—making information on "who's doing what" more accessible. A *current* current awareness service should also include references to papers presented at conferences, and those to be presented, and should place more emphasis on the more up-to-date report literature.

Knowledge of Information Sources

We educate librarians and many other information specialists, but why is so little done to educate users of information? A long succession of user studies has revealed that, in virtually all fields studied, there is a general lack of awareness of information resources. A significant proportion of the professional population is not aware of what information services exist in their fields. Many of those who are aware that certain services do exist have little idea of what these services can do for them. Other individuals may use certain information services but not know enough about these to exploit them most effectively.

A recent study among physicians in Toronto, as reported by Woodsworth and Neufeld,[12] is typical of the situation. The physicians surveyed were generally found to lack knowledge of important information services in medicine, including standard printed tools; virtually none had received any formal training in the use of science literature. Yet, and I believe this is highly

significant, the majority indicated that they would be interested in attending a seminar or short course on biomedical information retrieval.

Why aren't courses on the use of information resources integrated into university curricula? Within the physics curriculum, for example, there should be one or more courses on information retrieval in physics, covering both published and unpublished sources, including the major information services and centers existing in the field. Similar courses should exist in medicine, agriculture, engineering and other disciplines. A few such courses do exist, mostly in the field of chemistry, but they are few and far between. The education of users of information services has, in general, been sadly neglected. Perhaps this is a legitimate role for schools of library and information science to play. It is certainly a legitimate role for the information services profession. And it is an area that should greatly concern us. We cannot expect people to use information services which they know nothing about.

This brings me to the final point of my paper, a closely related one: the advertising of information services. This is another area that traditionally has been neglected. We tend to be somewhat complacent about the services we provide. In many instances, we seem content to establish some form of information service and then to sit back and wait for users to flock in. Sometimes very little flocking occurs. Perhaps we should concentrate on the sociometric stars—the gatekeepers—to bring our services to the attention of the scientific community. First, however, we must identify these stars and we must be certain that the services we provide are services which are really useful to the professional community—that they are user oriented and convenient to use. We need to apply established techniques of market analysis to determine what services are needed and we must involve users, from the beginning, in the actual design of these services.

This has been a very diffuse paper. It has ranged over many issues and raised a number of questions for which I do not necessarily have the answers. It will have served its purpose if it has encouraged you to look more critically at some of our achievements in the provision of information service. We have made great strides in the last twenty years, but major improvements are still possible and we cannot afford to be complacent about our achievements.

REFERENCES

1. Mooers, Calvin N. "Mooers' Law, or Why Some Retrieval Systems Are Used and Others Are Not," *American Documentation* 11:ii, July 1960.

2. Allen, Thomas J., and Gerstberger, P. G. *Criteria for Selection of an Information Source*. Cambridge, Mass., M. I. T., Sloan School of Management, 1967.

3. Rosenberg, Victor. *The Application of Psychometric Techniques to Determine the Attitudes of Individuals Toward Information Seeking* (Studies in the Man/System Interface in Libraries, Report No. 2). Bethlehem, Pa., Lehigh University, Center for the Information Sciences, 1966.

4. Soper, Mary E. "The Relationship between Personal Collections and the Selection of Cited References." Ph.D. thesis submitted to the University of Illinois Graduate School of Library Science, Urbana, Ill., 1972.

5. Crawford, Susan. "Informal Communication Among Scientists in Sleep Research," *Journal of the American Society for Information Science* 22:301-10, Sept.-Oct.1971.

6. Lancaster, F. W. "A Study of Current Awareness Publications in the Neurosciences," *Journal of Documentation* 30:255-72, Sept. 1974.

7. ————. "The Information Services Librarian," *Australian Special Libraries News* 7:139-49, Nov. 1974.

8. ————. "Can Present Methods for Library and Information Retrieval Services Survive?" *Proceedings of the 1971 Annual Conference of the Association for Computing Machinery*. New York, Association for Computing Machinery, 1971, pp. 564-77.

9. Dougherty, Richard M., and Blomquist, Laura L. *Improving Access to Library Resources*. Metuchen, N. J., Scarecrow Press, 1974.

10. NFAIS Document Access Committee. "NFAIS Position Statement on Document Access, 1975." Philadelphia, National Federation of Abstracting and Indexing Services, Jan. 1975, p. 1.

11. Herschman, Arthur. "The Primary Journal: Past, Present, and Future," *Journal of Chemical Documentation* 10:37-42, Feb. 1970.

12. Woodsworth, Anne, and Neufeld, Victor R. "A Survey of Physician Self-Education Patterns in Toronto. Part 1: Use of Libraries," *Canadian Library Journal* 29:38-44, Jan.-Feb. 1972.